Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

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European Technical Assessment ETA-25/0994 of 27 November 2025

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	HALFEN Serrated Mounting Channel HZM HALFEN Special Serrated Channel Bolts HZS
Product family to which the construction product belongs	Mounting Channels
Manufacturer	Leviat GmbH Liebigstraße 14 40764 Langenfeld GERMANY
Manufacturing plant	Leviat GmbH Liebigstraße 14 40764 Langenfeld GERMANY
This European Technical Assessment contains	25 pages including 20 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330667-01-0602

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Specific part

1 Technical description of the product

The HALFEN serrated hot-rolled mounting channel HZM is a system consisting of a C-shaped channel profile of carbon steel and stainless steel with serrated inner channel lips in combination with special HALFEN channel bolts HZS with matching serration on the channel bolt head, which are fixed with an appropriate hexagon nut and washer to the channel. The serrated mounting channel can be welded to the steel structure (fully or partially) or is mounted to the concrete by welded steel plates.

Figure 1 shows the principal setup of the construction product.

The product description is given in Annex A.

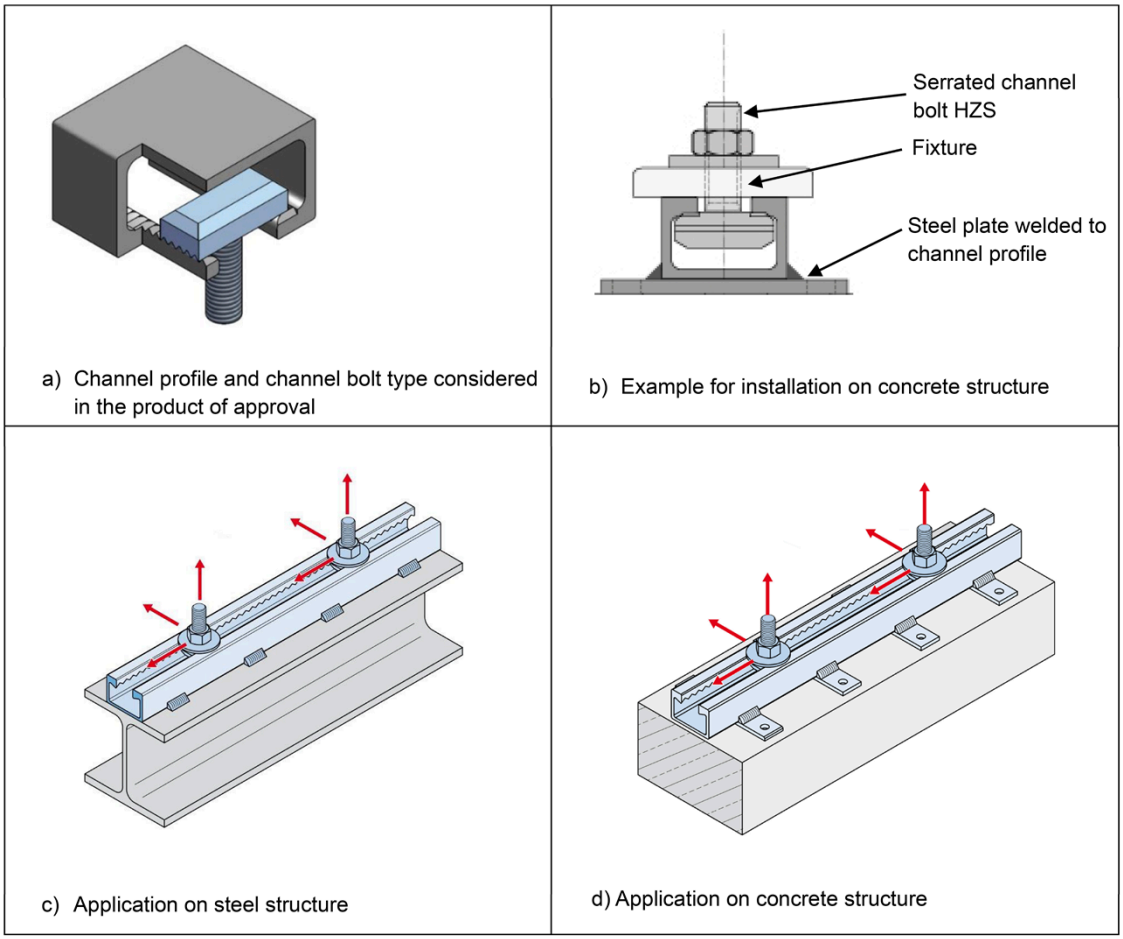


Figure 1: Principle setup of HALFEN serrated hot-rolled mounting channel with corresponding channel bolts

2 Specification of the intended use in accordance with the applicable European Assessment Document Mounting Channels 330667-01-0602

The performances given in Section 3 are only valid if the serrated mounting channel is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the mounting channel of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to he methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance under static and quasi-static tension load	
- Resistance to steel failure of channel lips and subsequently pull-out of channel bolt	$N^0_{Rk,s,l}$ see Annex C1
- Characteristic spacing of channel bolts	$s_{l,N}$ see Annex C1
- Resistance to steel failure of channel bolt	$N_{Rk,s}$ see Annex C2
- Steel failure by exceeding the bending strength of the channel	M_{pl} see Annex C1
- Maximum installation torque moment	T_{inst} see Annex B3
Characteristic resistance under static and quasi-static shear load	
- Resistance to steel failure of channel bolt under shear load in perpendicular direction without lever arm	$V_{Rk,s}$ see Annex C9
- Resistance to steel failure by bending of the channel bolt under shear load in perpendicular direction with lever arm	$M^0_{Rk,s}$ see Annex C9
- Resistance to local steel failure of channel lips under shear load in perpendicular direction	$V^0_{Rk,s,l,y}$ see Annex C3
- Characteristic spacing of the channel bolts under shear load in perpendicular direction to channel axis	$s_{l,V}$ see Annex C3
- Resistance to steel failure of connection between channel lips and channel bolt under shear load in longitudinal channel axis	$V^0_{Rk,s,l,x}$ see Annex C4 – C6
- Factor for sensitivity to installation	γ_{inst} see Annex C4 – C6
Characteristic resistance under combined static and quasi-static tension and shear load	
- Resistance to steel failure of the channel under combined tension and shear load	k_2 see Annex C9

Continuation:Table 3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance under static and quasi-static tension and/or shear loads - Displacements (static and quasi-static load)	δ_{N0} *and* $\delta_{N\infty}$ see Annex C1 $\delta_{V,y,0}$ *and* $\delta_{V,y,\infty}$ see Annex C3 $\delta_{V,x,0}$ *and* $\delta_{V,x,\infty}$ see Annex C7, C8
Installation parameters	see Annex B1 – B5
Geometric values	see Annex A4, A5
Characteristic resistance under fatigue tension load	No Performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1

3.3 Aspects of durability linked with the Basic Work Requirements

Essential characteristic	Performance
Durability	see Annex A2, A3, B1

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 330667-01-0602, the applicable European legal act is: 1998/214/EC

The system to be applied is: 2+

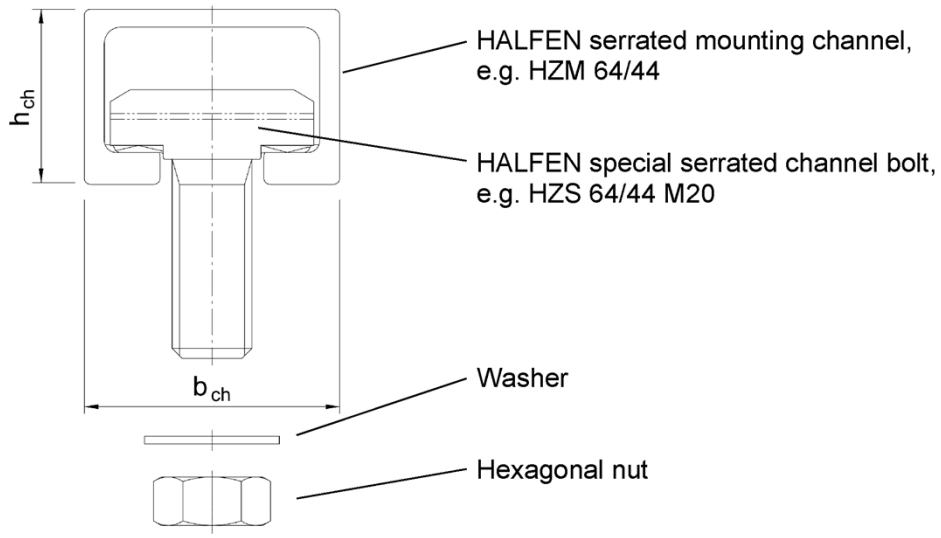
5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 27 November 2025 by Deutsches Institut für Bautechnik

Dr.-Ing. Ronald Schwuchow
Head of Section

beglaubigt:
Hahn



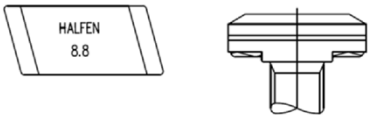
HALFEN serrated mounting channels HZM

HALFEN serrated mounting channels HZM	b_{ch} [mm]	h_{ch} [mm]
HZM 29/20	29,0	20,0
HZM 38/23	38,0	23,0
HZM 41/27	40,0	27,0
HZM 53/34	52,5	34,0
HZM 64/44	64,0	44,0

Material of serrated channels:

Steel	
MF, WB	Mill-finished, black (uncoated)
FV, HDG	hot-dip galvanized
Stainless steel	corrosion resistance class
A2, A3	CRC II
A4, A5	CRC III
D4	CRC III
FA, D6, A8	CRC IV
HCR, A8, D8	CRC V

Marking of the HALFEN special serrated channel bolts HZS, e.g.: HALFEN 8.8



H or HALFEN	Identifying mark of the producer
8.8	Strength grade

Material of special serrated channel bolts:

Steel	
No marking	
Stainless steel	corrosion resistance class
A2, A3	CRC II
A4, A5	CRC III
D4	CRC III
FA, D6, A8	CRC IV
HCR, A8, D8	CRC V

Strength grade of the special serrated channel bolts:

Steel	
8.8	Strength grade 8.8
Stainless steel	
70	Strength grade 70

HALFEN Serrated Mounting Channels HZM	Annex A1
Product description Marking and materials	

Table A1: Materials and intended use

Item no.	Specification	Intended use	
		1	**2**
		Dry internal conditions	**Internal conditions with usual humidity**
		Serrated mounting channels may only be used in structures subject to dry internal conditions	Serrated mounting channels may also be used in structures subject to internal conditions with usual humidity. For examples see use conditions in Annex B1.
		Materials	
①	Channel profile	**Carbon steel** hot-dip galv. ≥ 55 µm acc. to (E) black (uncoated)	**Carbon steel** hot-dip galv. ≥ 55 µm acc. to (E) **Stainless steel** [3] CRC II
②	HALFEN special serrated channel bolts	**Carbon steel** strength grade 8.8 (A) hot-dip galv. ≥ 50 µm acc. to (G) [1]	**Carbon steel** strength grade 8.8 (A) hot-dip galv. ≥ 50 µm acc. to (G) [1] **Stainless steel** [3] strength grade 70 (B) CRC II
③	Washer [2] (H) and (I) product grade A, 200 HV	**Carbon steel** electroplated ≥ 5 µm acc. to (F)	**Carbon steel** hot-dip galv. ≥ 50 µm acc. to (G) [1] **Stainless steel** [3] CRC II
④	Hexagonal nuts (J)	**Carbon steel** strength grade 8 (C) electroplated ≥ 5 µm acc. to (F)	**Carbon steel** strength grade 8 (C) hot-dip galv. ≥ 50 µm acc. to (G) [1] **Stainless steel** [3] strength grade 70, 80 (D) CRC II

Table A1 (continued): Materials and intended use

Item no.	Specification	Intended use		
		3	4	5
		according EN 1993-1-4:2006+A1:2015, Tab. A.2		
		For CRC III	For CRC IV	For CRC V
		Materials		
①	Channel profile	**Stainless steel** CRC III	**Stainless steel** CRC IV	**Stainless steel** CRC V
②	HALFEN special serrated channel bolts	**Stainless steel** strength grade 70 (B) CRC III	**Stainless steel** strength grade 70 (B) CRC IV	**Stainless steel** strength grade 70 (B) CRC V
③	Washer [2)] (H) and (I) production class A, 200 HV	**Stainless steel** CRC III	**Stainless steel** CRC IV	**Stainless steel** CRC V
④	Hexagonal nuts (J)	**Stainless steel** strength grade 70, 80 (D) CRC III	**Stainless steel** strength grade 70, 80 (D) CRC IV	**Stainless steel** strength grade 70, 80 (D) CRC V

A - EN ISO 898-1:2013+AC:2013
B - EN ISO 3506-1:2020
C - EN ISO 898-2:2022
D - EN ISO 3506-2:2020
E - EN ISO 1461:2022
F - EN ISO 4042:2022
G - EN ISO 10684:2004+AC:2009
H - EN ISO 7089:2000
I - EN ISO 7093-1:2000
J - EN ISO 4032:2023

[1)] or electroplated with special coating ≥ 12 µm
[2)] not included in scope of delivery
[3)] stainless steel channel profiles only in combination with stainless steel channel bolts, washers and nuts

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HALFEN Serrated Mounting Channels HZM

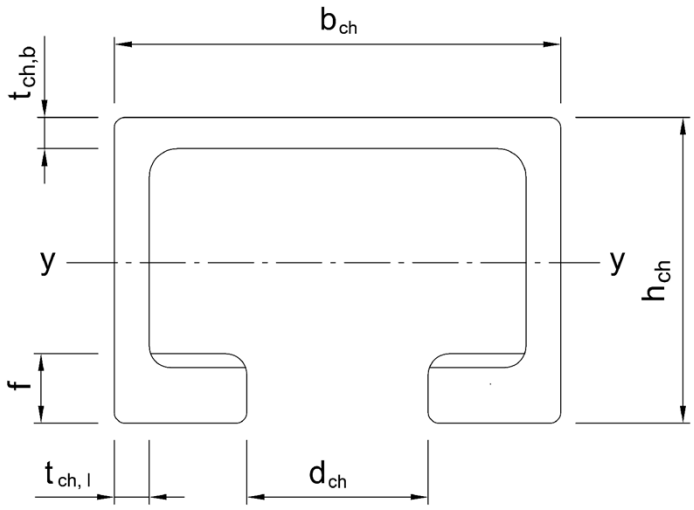

Table A2: HALFEN serrated mounting channels HZM – Dimensions (carbon steel and stainless steel)

Serrated mounting channel HZM	Material	Dimensions						
		b_{ch}	h_{ch}	$t_{ch,b}$	$t_{ch,l}$	d_{ch}	f	I_y
		[mm]						[mm^4]
29/20	Carbon steel	29,0	20,0	2,5	2,5	14,0	5,0	10.200
38/23	Carbon steel & stainless steel	38,0	23,0	3,5	3,0	18,0	5,5	21.100
41/27	Carbon steel	40,0	27,0	4,2	4,0	18,0	7,0	39.000
53/34	Carbon steel & stainless steel	52,5	34,0	4,0	4,0	22,5	7,5	92.600
64/44	Carbon steel & stainless steel	64,0	44,0	4,5	5,0	26,0	10,0	240.300

HALFEN Serrated Mounting Channels HZM	Annex A4
Product description Profile dimensions	

HALFEN Special Serrated Channel Bolts HZS

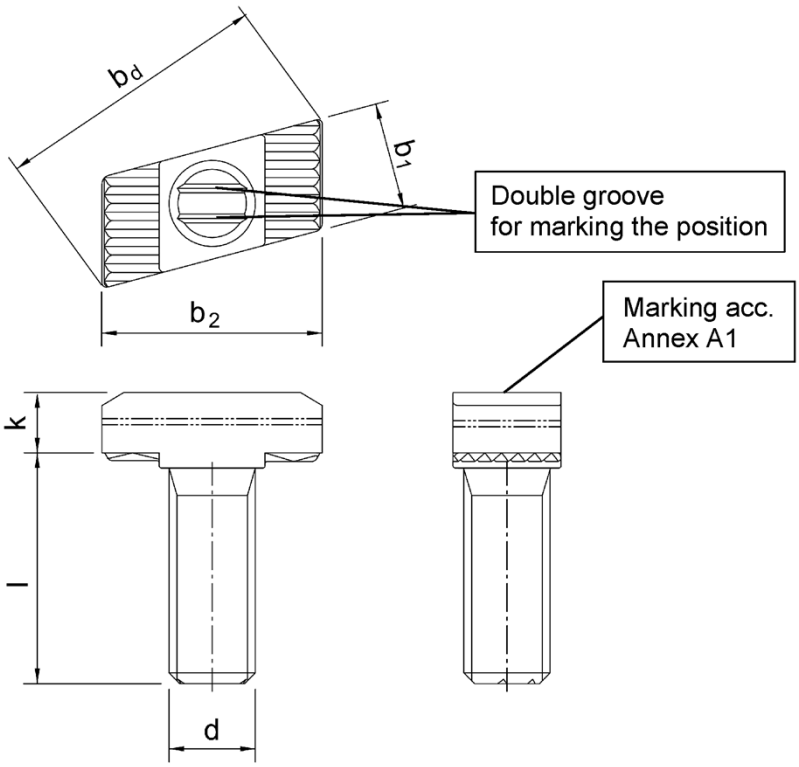

Table A3: HALFEN special serrated channel bolts HZS – Dimensions (carbon steel and stainless steel)

Mounting channel HZM	Channel bolt HZS	Material	Thread diameter	Width b_1	Diagonal b_d	Length b_2	Thickness k
				[mm]			
29/20	HZS 29/20	8.8	M12	13,4	27,1	20,9	6,5
38/23 and 41/27	HZS 38/23	8.8 A4-70	M12	17,0	37,0	28,8	8,0
		8.8 A4-70	M16	17,0	37,0	28,8	8,0
53/34	HZS 53/34	8.8 A4-70	M16	21,0	51,6	41,6	11,5
		8.8 A4-70	M20	21,0	51,6	41,6	13,0
64/44	HZS 64/44	8.8 A4-70	M20	24,7	63,1	51,0	14,0
		8.8 A4-70	M24	24,7	63,1	51,0	16,0

HALFEN Serrated Mounting Channels HZM	Annex A5
Product description HALFEN special serrated channel bolts HZS, dimensions	

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Table A4: HALFEN special serrated channel bolts HZS – Strength grade

	Steel [1)]	Stainless steel, strength grade 70 [1)]
Strength grade	8.8	70
f_{uk} [N/mm²]	800	700
f_{yk} [N/mm²]	640	450
Finish	Hot-dip galvanized, Electroplated	–

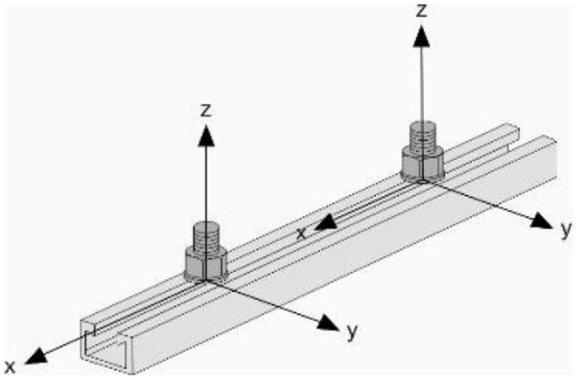
[1)] Materials according to Annex A1 and Annex A2-A3, Tab. A1

HALFEN Serrated Mounting Channels HZM	Annex A6
Product description HALFEN special serrated channel bolts HZS, strength grade	

Specifications for intended use

Serrated mounting channels and special serrated channel bolts subject to:

- Static and quasi-static tension (z-direction), shear perpendicular to the longitudinal axis of the channel (y-direction) and shear in the direction of the longitudinal axis of the channel (x-direction).
- Shear loads with and without lever arm.
- HALFEN serrated mounting channels can be connected to the steel-structure by direct welding (fully or partially) or by lugs welded to the channel walls (e.g. for concrete structures).



tension load:
z-direction (in direction of bolt)

shear load:
y-direction (perpendicular to longitudinal axis of channel)

shear load:
x-direction (in longitudinal channel axis)

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
  (serrated mounting channels and serrated channel bolts according to Annex A2-A3, Table A1, column 1 - 5)
- Structures subject to internal conditions with usual humidity (e.g. kitchen, bath and laundry in residential buildings, exceptional permanent damp conditions and application under water)
  (serrated mounting channels and serrated channel bolts according to Annex A2-A3, Table A1, column 2 - 5)
- According to EN 1993-1-4:2006+A1:2015+A2:2020 relating to corrosion resistance class CRC III
  (serrated mounting channels and serrated channel bolts according to Annex A2-A3, Table A1, column 3 - 5)
- According to EN 1993-1-4:2006+A1:2015+A2:2020 relating to corrosion resistance class CRC IV
  (serrated mounting channels and serrated channel bolts according to Annex A2-A3, Table A1, column 4 - 5)
- According to EN 1993-1-4:2006+A1:2015+A2:2020 relating to corrosion resistance class CRC V
  (serrated mounting channels and serrated channel bolts according to Annex A2-A3, Table A1, column 5)

HALFEN Serrated Mounting Channels HZM	Annex B1
Intended use Specifications	

Design:

- HALFEN serrated mounting channels are designed under the responsibility of an engineer experienced in framing systems and bolted connections.
- For static and quasi-static loading the serrated mounting channels are designed according to Annexes B and C and EOTA Technical Report 076 “Design of mounting channels”, December 2020, and EN 1993-1-1.
- The welding seams are calculated in accordance to EN 1993-1-8 (supplementary rules for stainless steel given in EN 1993-1-4). For partially fillet welded profiles the maximum spacing between weld beads (Annex B4, Table B2) must be observed. The minimum welding length has to be observed.

Installation:

- The installation of mounting channels is carried out by appropriately qualified personnel under the supervision of the person responsible for the technical matters on site.
- Use of HALFEN serrated mounting channels only as supplied by the manufacturer without any alterations. Serrated mounting channels and serrated channel bolts are a complete system and must always be used as a set.
- For mounting channels made of stainless steel there are no restrictions regarding corrosion resistance when using cut channel pieces, if cutting is done professionally and contamination of cutting edges with corroding material is avoided.
- For the cutting of mounting channels the minimum channel length $l_{ch,min}$ given in Annex B4, Table B2 must be observed.
- Black (uncoated) channels should be protected against corrosion as required for the environmental conditions.
- Washers may be chosen according to Annex A2-A3 and provided separately by the user.
- Orientating the channel bolt (according to Annex B5) rectangular to the channel axis.
- The required installation torque given in Annex B3 must be applied and must not be exceeded.

Transport and storage of mounting channels made of stainless steel:

- Mounting channels made of stainless steel must be stored separately from carbon steel and other metallic materials to avoid surface contamination.
- Store in a dry place.

HALFEN Serrated Mounting Channels HZM	
Intended use Specifications	Annex B2

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Table B1: HALFEN special serrated channel bolts HZS – Installation torque

Serrated mounting channel HZM	HALFEN serrated channel bolts D	Installation torque T_{inst} [2]	
		Steel 8.8[1]	Stainless steel 70[1]
	[mm]	[Nm]	
29/20	12	75	–[3]
38/23	12	75	50
	16	185	130
41/27	12	75	–[3]
	16	185	–[3]
53/34	16	185	130
	20	360	250
64/44	20	360	250
	24	625	435

[1] Materials according to Annex A1 and Annex A2-A3, Tab. A1
[2] T_{inst} must not be exceeded
[3] Product not available

HALFEN Serrated Mounting Channels HZM

Intended use
Installation torque of HALFEN special serrated channel bolts HZS

Annex B3

Table B2: HALFEN serrated mounting channels HZM – Installation parameters

Serrated mounting channel HZM		**29/20**[2)]	**38/23**[1)]	**41/27**[2)]	**53/34**[1)]	**64/44**[1)]
Minimum welding length	$l_{w,min}$ [mm]	56	56	70	70	70
Maximum spacing between weld beads	s_{max} [mm]	250	250	250	250	250
Minimum channel length	$l_{ch,min}$ [mm]	100	100	100	100	100
End spacing	x_{min} [mm]	28	28	35	35	35

[1)] Carbon steel and stainless steel available
[2)] Only in Carbon steel available

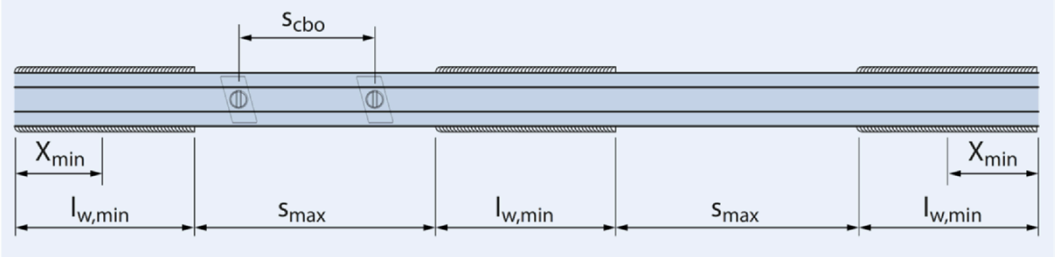

Table B3: HALFEN special serrated channel bolts HZS – Minimum spacing $s_{min,cbo}$

Diameter D of special serrated channel bolts HZS		**M12**	**M16**	**M20**	**M24**
Minimum spacing between serrated channel bolts HZS	$s_{min,cbo}$ [mm]	60	80	100	120

HALFEN Serrated Mounting Channels HZM	
Intended use Installation parameters of HALFEN serrated mounting channels and minimum spacing of special serrated channel bolts HZS	Annex B4

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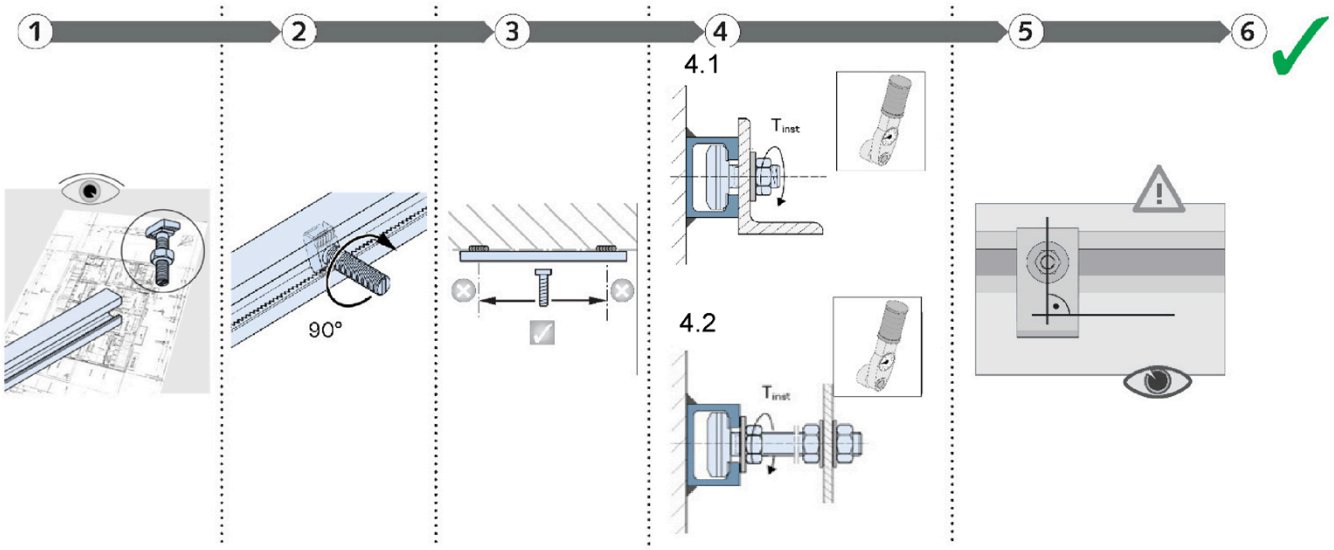
Installation of HALFEN special serrated channel bolts



Selection of the HALFEN channel bolts in accordance with the planning document.	Insert the HALFEN channel bolts into the channel slot. After a 90° turn clockwise the HALFEN screw locks into position (check whether the groove mark is perpendicular to the channel longitudinal axis).	Positioning of the HALFEN channel bolts: The bolts must not be mounted nearer to the channel ends than x_{min} (Annex B4, Table B2)	Tighten the hexagonal nut to the installation torque ($T_{inst.}$) acc. table stated below. T_{inst} must not be exceeded. 4.1: general application, 4.2: installation with lever arm	After tightening the nut check if the groove mark on the HALFEN channel bolt is perpendicular to the channel longitudinal axis. If it is not perpendicular the screw must be completely loosened, re-inserted and tightened again.

Table B4: HALFEN special serrated channel bolts HZS – Installation torque

Material strength grade of serrated bolts HZS		Serrated mounting channel HZM	T_{inst} [Nm] [1]			
			M12	M16	M20	M24
Carbon Steel	8.8	All profiles depending on availability of of material and diameter[2]	75	185	360	625
Stainless steel	70		50	130	250	435

[1] T_{inst} must not be exceeded
[2] According to Annex B3, Tab. B1

HALFEN Serrated Mounting Channels HZM	Annex B5
Intended use Installation instruction of HALFEN special serrated channel bolts HZS	

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Table C1: HALFEN serrated mounting channels HZM – Characteristic resistances under tension load (steel failure)

Serrated mounting channel HZM			Steel	29/20	38/23	41/27	53/34	64/44
Steel failure of channel lips								
Characteristic resistance	$N^0_{Rk,s,l}$	[kN]	carbon	26,3	42,8	56,0	83,9	104,4
			stainless	–[2)]	38,7	–[2)]	65,8	114,3
Spacing of channel bolts for $N_{Rk,s,l}$	$s_{l,N}$	[mm]	carbon	58,0	76,0	80,0	105,0	128,0
			stainless	–[2)]		–[2)]	105,0	128,0
Partial factor	$\gamma_{Ms,l}$ [1)]	[-]		1,8				

[1)] In absence of other national regulations
[2)] No performance assessed

Table C2: Characteristic resistance of the channels by bending under tension load

Serrated mounting channel HZM			Steel	29/20	38/23	41/27	53/34	64/44
Steel failure by bending of channel under tension load								
Characteristic bending resistance of channel	M_{pl}	[Nm]	carbon	472	832	1346	2466	4954
			stainless	–[2)]	832	–[2)]	2466	4954
Partial factor	$\gamma_{Ms,flex}$ [1)]			1,15				

[1)] In absence of other national regulations
[2)] No performance assessed

Table C3: Displacements of the channels under tension load

Serrated mounting channel HZM			Steel	29/20	38/23	41/27	53/34	64/44
Tension load	N	[kN]	carbon	10,4	17,0	22,2	33,3	41,4
			stainless	–[1)]	15,4	–[1)]	26,1	45,4
Short-term displacement	δ_{N0}	[mm]	carbon	0,5	1,1	0,8	0,9	1,2
			stainless	–[1)]	0,4	–[1)]	0,9	1,3
Long-term displacement	$\delta_{N\infty}$	[mm]	carbon	1,2	2,2	1,6	1,8	2,4
			stainless	–[1)]	0,8	–[1)]	1,8	2,6

[1)] No performance assessed

HALFEN Serrated Mounting Channels HZM	Annex C1
Performances Characteristic resistances and displacements under tension load of serrated mounting channels HZM	

Table C4: HALFEN special serrated channel bolts HZS – Characteristic resistances under tension load

HALFEN serrated channel bolt HZS, thread diameter					**M12**	**M16**	**M20**	**M24**
Steel failure: Resistance of channel bolt under tension load								
Characteristic resistance	$N_{Rk,s}$	[kN]	Carbon steel	8.8	67,4	125,6	196,0	282,4
			Stainless steel	70[1)]	59,0	109,9	171,5	247,1
Partial factor	γ_{Ms} [2)]	[-]	Carbon steel	8.8	1,50			
			Stainless steel	70[1)]	1,87			

[1)] Materials according Annex A1, A2 and A3
[2)] In absence of other national regulations

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Table C5: HALFEN serrated mounting channels HZM – Characteristic resistances under shear load in perpendicular direction to channel axis

Serrated mounting channel HZM			Steel	29/20	38/23	41/27	53/34	64/44
Steel failure: Resistance of channel lips under shear load in perpendicular direction								
Characteristic resistance	$V^0_{Rk,s,l,y}$	[kN]	carbon	4,1	22,5	21,4	27,4	41,7
			stainless	2)	14,7	2)	26,6	31,4
Spacing of channel bolts for $V_{Rk,s,l}$	$s_{l,V}$	[mm]	carbon	100	100	100	120	120
			stainless	2)	100	2)	120	100
Partial factor	$\gamma_{Ms,l}$ 1)	[-]		1,8				

1) In absence of other national regulations
2) No performance assessed

Table C6: Displacements under shear load in perpendicular direction to channel axis under shear load

Serrated mounting channel HZM			Steel	29/20	38/23	41/27	53/34	64/44
Shear load in y-direction 1)	V_y	[kN]	carbon	1,6	8,9	8,5	10,9	16,5
			stainless	–2)	5,8	–2)	10,6	12,5
Short-term displacement in y-direction	$\delta_{V,y,0}$	[mm]	carbon	0,3	1,9	0,6	0,9	0,9
			stainless	–2)	0,3	–2)	1,3	0,8
Long-term displacement in y-direction	$\delta_{V,y,\infty}$	[mm]	carbon	0,5	2,9	0,9	1,4	1,4
			stainless	–2)	0,5	–2)	2,0	1,2

1) y-direction: perpendicular to longitudinal axis of the mounting channel
2) No performance assessed

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Table C7: HALFEN serrated mounting channels HZM in carbon steel black (uncoated, mill finished) – Characteristic resistances under shear load in longitudinal axis

Serrated mounting channel, carbon steel black				29/20	38/23	41/27	53/34	64/44
Steel failure: Connection between channel lips and channel bolt under shear loading in longitudinal axis for black channels								
Characteristic resistance	$V_{Rk,s,l,x}$ [kN]	M12	electroplated	14,8	22,7	22,7	–[1]	–[1]
			hot-dip galvanized	15,2	28,6	28,6	–[1]	–[1]
		M16	electroplated	–[1]	22,7	22,7	46,7	–[1]
			hot-dip galvanized	–[1]	28,6	28,6	48,8	–[1]
		M20	electroplated	–[1]	–[1]	–[1]	46,7	82,8
			hot-dip galvanized	–[1]	–[1]	–[1]	48,8	85,1
		M24	electroplated	–[1]	–[1]	–[1]	–[1]	82,8
			hot-dip galvanized	–[1]	–[1]	–[1]	–[1]	85,1
Installation factor	γ_{inst} [-]	M12	electroplated	1,0	1,0	1,0	–[1]	–[1]
			hot-dip galvanized	1,2	1,2	1,2	–[1]	–[1]
		M16	electroplated	–[1]	1,0	1,2	1,2	–[1]
			hot-dip galvanized	–[1]	1,2	1,2	1,0	–[1]
		M20	electroplated	–[1]	–[1]	–[1]	1,2	1,0
			hot-dip galvanized	–[1]	–[1]	–[1]	1,0	1,0
		M24	electroplated	–[1]	–[1]	–[1]	–[1]	1,0
			hot-dip galvanized	–[1]	–[1]	–[1]	–[1]	1,0
Partial factor	$\gamma_{Ms,l}$ [2] [-]			1,8				

[1] No performance assessed
[2] In absence of other national regulations

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Table C8: HALFEN serrated mounting channels HZM in hot-dip galvanized (HDG) – Characteristic resistances under shear load in longitudinal axis

Serrated mounting channel in hot-dip galvanized				29/20	38/23	41/27	53/34	64/44
Steel failure: Connection between channel lips and channel bolt under shear loading in longitudinal axis for HDG channels								
Characteristic resistance	$V_{Rk,s,l,x}$ [kN]	M12	electroplated	9,9	20,7	20,7	–[1]	–[1]
			hot-dip galvanized	13,9	20,1	20,1	–[1]	–[1]
		M16	electroplated	–[1]	20,7	20,7	37,4	–[1]
			hot-dip galvanized	–[1]	20,1	20,1	39,7	–[1]
		M20	electroplated	–[1]	–[1]	–[1]	37,4	71,5
			hot-dip galvanized	–[1]	–[1]	–[1]	39,7	77,1
		M24	electroplated	–[1]	–[1]	–[1]	–[1]	71,5
			hot-dip galvanized	–[1]	–[1]	–[1]	–[1]	77,1
Installation factor	γ_{inst} [-]	M12	electroplated	1,0	1,0	1,0	–[1]	–[1]
			hot-dip galvanized	1,0	1,0	1,0	–[1]	–[1]
		M16	electroplated	–[1]	1,0	1,0	1,4	–[1]
			hot-dip galvanized	–[1]	1,0	1,0	1,0	–[1]
		M20	electroplated	–[1]	–[1]	–[1]	1,4	1,0
			hot-dip galvanized	–[1]	–[1]	–[1]	1,0	1,2
		M24	electroplated	–[1]	–[1]	–[1]	–[1]	1,0
			hot-dip galvanized	–[1]	–[1]	–[1]	–[1]	1,2
Partial factor	$\gamma_{Ms,l}$ [2] [-]			1,8				

[1] No performance assessed
[2] In absence of other national regulations

Table C9: HALFEN serrated mounting channels HZM in stainless steel – Characteristic resistances under shear load in longitudinal axis

Serrated mounting channel in stainless steel				**38/23**	**53/34**	**64/44**
Steel failure: Connection between channel lips and channel bolt under shear loading in longitudinal axis for stainless steel channels						
Characteristic resistance	$V_{Rk,s,l,x}$ [kN]	M12	Stainless steel	–[1]	–[1]	–[1]
		M16	Stainless steel	29,9	36,8	–[1]
		M20	Stainless steel	–[1]	36,8	83,3
		M24	Stainless steel	–[1]	–[1]	83,3
Installation factor	γ_{inst} [-]	M12	Stainless steel	–[1]	–[1]	–[1]
		M16	Stainless steel	1,2	1,0	–[1]
		M20	Stainless steel	–[1]	1,0	1,2
		M24	Stainless steel	–[1]	–[1]	1,2
Partial factor	$\gamma_{Ms,l}$ [2] [-]			1,8		

[1] No performance assessed
[2] In absence of other national regulations

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Table C10: Carbon steel black (uncoated) channels – Displacements under shear load in longitudinal axis

Serrated mounting channel HZM carbon steel black (uncoated)			**Serrated channel bolt HZS**	**29/20**	**38/23**	**41/27**	**53/34**	**64/44**
Shear load in x-direction [1)]	V_x	[kN]	electroplated	5,9	9,0	9,0	18,5	32,9
			hot-dip galvanized	6,0	11,3	11,3	19,4	33,8
Short-term displacement in x-direction	$\delta_{V,x,0}$	[mm]	electroplated	0,4	0,6	0,4	1,3	0,9
			hot-dip galvanized	0,4	0,7	0,4	0,9	0,7
Long-term displacement in x-direction	$\delta_{V,x,\infty}$	[mm]	electroplated	0,6	0,9	0,6	1,9	1,3
			hot-dip galvanized	0,6	1,0	0,6	1,4	1,0

[1)] x-direction: in longitudinal axis of the mounting channel

Table C11: Hot-dip galvanized (HDG) channels – Displacements under shear load in longitudinal axis

Serrated mounting channel HZM hot-dip galvanized			**Serrated channel bolt HZS**	**29/20**	**38/23**	**41/27**	**53/34**	**64/44**
Shear load in x-direction [1)]	V_x	[kN]	electroplated	3,9	8,2	8,2	14,8	28,4
			hot-dip galvanized	5,5	8,0	8,0	15,8	30,6
Short-term displacement in x-direction	$\delta_{V,x,0}$	[mm]	electroplated	0,2	0,3	0,2	0,6	0,8
			hot-dip galvanized	0,5	0,4	0,2	0,6	0,8
Long-term displacement in x-direction	$\delta_{V,x,\infty}$	[mm]	electroplated	0,3	0,5	0,3	0,9	1,2
			hot-dip galvanized	0,8	0,6	0,3	0,9	1,2

[1)] x-direction: in longitudinal axis of the mounting channel

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Table C12: Stainless steel channels – Displacements under shear load in longitudinal axis

Serrated mounting channel HZM stainless steel			**Serrated channel bolt HZS**	**38/23**	**53/34**	**64/44**
Shear load in x-direction [1)]	V_x	[kN]	Stainless steel	11,9	14,6	33,0
Short-term displacement in x-direction	$\delta_{V,x,0}$	[mm]	Stainless steel	0,5	1,1	0,9
Long-term displacement in x-direction	$\delta_{V,x,\infty}$	[mm]	Stainless steel	0,7	1,7	1,3

[1)] x-direction: in longitudinal axis of the mounting channel

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Performances Displacements under shear load in longitudinal axis (stainless steel channels)	

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Table C13: HALFEN special serrated channel bolts HZS – Characteristic resistances under shear load (steel failure)

HALFEN special serrated channel bolt HZS					M12	M16	M20	M24
Steel failure: Resistance of channel bolts under shear load								
Characteristic resistance	$V_{Rk,s}$	[kN]	Carbon steel	8.8	33,7	62,8	98,0	141,2
			Stainless steel	70[1)]	35,4	65,9	102,9	148,3
Characteristic flexural resistance	$M^0_{Rk,s}$	[Nm]	Carbon steel	8.8	105	266	519	898
			Stainless steel	70[1)]	92	233	454	786
Partial factor	γ_{Ms} [2)]	[-]	Carbon steel	8.8	1,25			
			Stainless steel	70[1)]	1,56			

[1)] Materials according Annex A1, A2 and A3
[2)] In absence of other national regulations

Table C14: HALFEN serrated mounting channels HZM – Characteristic resistance under combined tension and shear loads

Serrated mounting channel HZM		29/20	38/23	41/27	53/34	64/44
Steel failure: Local flexure of channel lips and failure by flexure of channel						
Product factor	k_2 [-]	2,0				